

Natural Gas Technologies

Program Mission

The mission of the Natural Gas Technologies Program is to create public benefits by investing in research that the gas industry would not take on itself: long-term, high-risk research with potentially high payoffs for the public. These payoffs include a cleaner environment, more secure and stable supplies and new potential resources. The President's National Energy Policy states that 21st century technology is the key to environmental protection and new energy production, and Federal research can augment industry's technology development efforts in ways that target the public interest. These efforts will help the industry ensure that adequate supplies of reasonably-priced natural gas is available to meet expected future demands, while also ensuring that they are developed in an environmentally sound manner.

Fossil Energy programs are being realigned to specifically support the President's climate change, Clear Skies, and energy security goals. Through the implementation of the President's Management Agenda, the Natural Gas Technologies and Oil Technology programs completed Investment Criteria Scorecards of all program elements. The programs also completed the Program Assessment Rating Tool (PART) for all program elements. Analysis of PART showed that the program did not link annual goals to long-term benefits. In addition, the program was determined to have poor results and to duplicate industry work.

The budget now reflects the funding requested to implement the program mission and goals, such as Sustainable Supply, Hydrogen from Gas, and Environmental Science. This allows the program to phase out projects and activities that are neither productive nor integral to the program's mission and goals. Investments will maximize the efficiency of taxpayer dollars by focusing solely on activities that require a Federal presence to attain the President's goals of energy security, Clear Skies, and climate change.

For example, the President's climate change and security goals are addressed through participation in potentially high-payoff research and technology development in methane hydrates and a new effort on hydrogen from natural gas. Methane hydrates, ice-like formations in Alaska and offshore, contain more energy than all other fossil energy resources. Developing the ability to economically produce this resource has the potential to shift the world energy balance. Natural gas will be integral in the transition to a hydrogen economy, and the program will target ways to reduce the cost of creating hydrogen fuels as part of the Freedom Fuel effort. Improving environmental compliance and lowering cost to producers can help support the President's Clear Skies Initiative, ensuring that the growing role of natural gas, particularly in power generation, can be met with reliable and affordable supplies in an environmentally sound manner. Targeting university-based, long-term projects, the President's energy security priority is addressed by ensuring that research and technology development support a knowledge base for a vibrant U.S. oil and gas industry. This includes research that supports sound policy decision-making and makes the U.S. the world leader in cutting edge technology that meets the challenge of efficient production while protecting the environment.

Program Strategic Performance Goals

Sub-programs in the Natural Gas Technologies program support two Program Strategic Performance Goals (PSPG):

ER5-1: By 2008, develop advanced technologies and employ scientifically based policy options to increase the Nation's economically recoverable resource by 15 trillion cubic feet (Tcf) for natural gas and 140 million barrels for oil and reduce future costs of exploration and production by \$10 billion. According to the USGS, EIA, and MMS, the economically recoverable oil resource base is estimated to be 120 billion barrels at \$18/bbl. and 149 billion barrels at \$30/bbl; the gas base is estimated to be 740 Tcf at \$2.00/thousand cubic feet (mcf) and 920 Tcf at \$3.50/mcf in 2002.

ER5-2: By 2015, conduct scientific analyses and develop and field test a suite of methane hydrate characterization and diagnostic technologies that will do the following: provide a reliable inventory of Alaskan methane hydrate resources and resolve global environmental implications of natural methane hydrate instability. By 2008, reduce the cost of producing hydrogen from natural gas by 15 percent.

Each of the four sub-programs under Natural Gas Technologies has a set of performance measures including subprogram goals, performance indicators, and annual targets. The Sustainable Supply activity, performed within the Exploration and Production subprogram, and the Environmental Science activity, performed within the Effective Environmental Protection subprogram, support the Department's Program Strategic Performance Goal (PSPG) ER5-1, and have the following goal:

- By 2008, develop and field test a suite of natural gas technologies with the potential to expand the domestic economically-recoverable resource in existing conventional and unconventional reservoirs by 14 trillion cubic feet (Tcf) and reduce the environmental impact of the upstream natural gas industry by reducing the number of wells required to discover and produce a given volume of resource by 30 percent. (Economically recoverable resources were estimated to be 740 Tcf at \$2.00/mcf and 920 Tcf at \$3.50/mcf in 2002.)

The Gas Hydrates subprogram supports PSPG ER5-2 and has the following goals:

- By 2015, conduct scientific analyses and develop and field test a suite of methane hydrate characterization and diagnostic technologies that will:
 - develop knowledge and technologies necessary for the future commercial production of methane from hydrates, while protecting the environment.
 - resolve the global environmental implications of natural methane hydrate instability, and provide reliable inventory of the Arctic methane hydrate resources.

The Hydrogen from Natural Gas activity, performed within the Emerging Processing Technology subprogram, supports PSPS ER 5.2 and has the following goals:

- By 2008, reduce the cost of producing and separating hydrogen from natural gas by 15 percent.

Performance Indicators

The indicator for progress in the Sustainable Supply activity will be as follows:

- Annual estimates of the change in economically-recoverable resources (ERR) attributable to program activities. ERR is defined as the segment of the nation's total gas endowment that is recognized as being available for profitable production under prevailing technologies and prices assuming standard industry economic hurdle rates.

The indicators for progress in the Hydrogen from Natural Gas activity with the Gas Hydrates subprogram will be as follows:

- Improved understanding of the role of naturally-occurring hydrate on global climate, global carbon cycle, and the evolution of the sea-floor are published.
- Improved assessment of the nature, volume, and technical and economic recoverability of Arctic resources.
- Reduced cost of hydrogen from natural gas and reduced environmental impacts.

Annual Performance Targets and Results

FY 2004 annual proposed targets and associated quarterly milestones continue to be refined using OMB's guidance to better link annual outputs to long-term outcomes and to reflect the refocusing of the research into areas with a strong Federal role. Effective Environmental Protection performance targets for both the Natural Gas Technologies and Oil Technology programs are contained in the Oil Technology section of this budget listing.

Program Benefits

Each year Fossil Energy estimates the benefits of program activities to support Government Performance and Results Act (GPRA) reporting. Methods are complex and vary by program. The Oil and Gas Programs have traditionally used two separate economic and engineering modeling systems to calculate selected economic and energy security benefits. In 2002, a two-year effort, involving external peer review, was begun to integrate these two separate modeling systems into one system for improved simulation of resource and market conditions, and consistency of technology assumptions and model outputs. Under the previous two model systems, deficiencies, such as the assumption of unlimited industry capital availability, could result in an overestimation of industry's response to DOE's R&D products. Conversely, deficiencies, such as only modeling upstream R&D activities and not calculating the synergistic benefits of oil and gas R&D efforts, could result in an underestimation of the benefits of DOE programs.

The new model will provide the following expected benefits:

- Complimentary technology development in oil and gas research.
- Full R&D program activities can be modeled.

- Ability to calculate synergistic benefits of the oil program on gas production and the gas program on oil production.

As part of the effort to conform to the President's Management Agenda in a shorter-term, Fossil Energy has undertaken an integrated program benefits analysis of oil, natural gas, coal and power systems research within Fossil Energy to develop Fossil Energy-wide program benefits estimates. This analysis, using the Energy Information Administration National Energy Modeling System (NEMS) and scheduled to be completed in mid-2003, is examining all Fossil Energy research programs on a common basis with respect to modeling assumptions and should enable aggregate and comparative assessments of the benefits of Fossil Energy research programs. This spring, a complete explanation of methodology and assumptions will be posted on the Department's website.

FY 2002 Results	FY 2003 Updated Targets	FY 2004 Targets
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ER 5.1

Demonstrate safe economic slimhole drilling technology in actual use under Arctic conditions. This technology can significantly reduce cost and environmental impacts. (ER5-1) (Met goal)

Develop and demonstrate two technologies to detect and quantify areas of high fracture density in currently uneconomic low permeability gas reservoirs. This program has the near-term commercial potential to double average per-well productivity. (ER5-1) (Met goal)

Research: Complete basin model for the Wind River basin and well site selection in the Greater Green River Basin to evaluate integrated remote sensing, seismic surveys and basin structural analysis to differentiate gas-bearing from uneconomic fractured reservoirs.

Complete a conceptual model of regional water distribution to help operators avoid poor production areas.

Development: Conduct two field tests of improved drilling technology that will improve the productivity of gas reservoirs and reduce drilling costs.

Conduct two field tests of technologies to improve natural fracture detection to increase the percentage of economically producing wells of all wells drilled.

Research: Complete and release software that more accurately predicts well performance in fractured gas reservoirs by integrating seismic and fracture models into production simulator.

Complete assessment of gas-in-place for new basins.

Demonstration: Conduct one field test of improved technology for enhanced stripper well production.

Conduct one field test of enhanced drill pipe telemetry system to improve data transmission from bottom of wellbore to surface.

Conduct one field test of advanced fracture stimulation design for tight sands.

FY 2002 Results	FY 2003 Updated Targets	FY 2004 Targets
ER5.2	Build and have field-ready an initial prototype of a 400-geophone receiver array to improve seismic resolution necessary to locate economically productive gas zones.	
	Research: Complete hydrate modeling for Alaska drilling program.	Research: Refine hydrate models based on results of lab and field work.
	Report strength and thermal property tests at national labs.	Issue the first competitive solicitations for Hydrogen from Gas initiative to study the fundamental science of hydrogen production and separation from natural gas.
	Develop prototype Raman Spectroscopy to use lasers to define hydrate molecular structure.	
	Development: Complete initial report of improved hydrate coring device on Ocean Drilling Program, Leg 204.	Development: Complete small methane hydrate coring project in the Gulf of Mexico.
	Drill one test well to determine aerial extent of hydrate occurrence in Alaska.	Issue final reports: improved hydrate coring device on Ocean Drilling Program, Leg 204; resource assessment of hydrates in Alaska.
	Complete evaluation of hydrate occurrence in Gulf of Mexico to understand the interaction of hydrate and seafloor stability.	Down-select from existing hydrogen production research projects initially funded under different programs. Award competitively selected, cost-shared, cooperative agreements to develop advanced technologies to produce hydrogen at lower cost.

Funding Profile

(dollars in thousands)

	FY 2002 Comp. Approp.	FY 2003 Request	FY 2004 Base	FY 2004 Request	FY 2004 Request vs. Base	
					\$ Change	% Change
Exploration and Production . . .	\$19,964	\$15,450	\$15,450	\$14,000	\$-1,450	-9.4%
Gas Hydrates	9,568	4,500	4,500	3,500	-1,000	-22.2%
Infrastructure	9,809	0	0	0	0	100.0%
Emerging Processing Technology	2,191	0	0	6,555	6,555	100.0%
Effective Environmental Protection	2,537	2,640	2,640	2,500	-140	-5.3%
Total, Natural Gas Technologies	\$44,069	\$22,590	\$22,590	\$26,555	\$3,965	17.6%

Funding by Site

(dollars in thousands)

	FY 2002	FY 2003	FY 2004	\$Change	%Change
Argonne National Lab (East)	\$231	\$226	\$0	\$-226	100.0%
Idaho National Engineering Lab	100	0	0	0	0.0%
Lawrence Berkeley Lab	900	555	350	-205	-36.9%
Lawrence Livermore National Laboratory . .	95	0	0	0	0.0%
National Energy Technology Laboratory . .	1,125	400	1,150	750	187.5%
Oak Ridge National Laboratory	200	0	0	0	0.0%
Pacific Northwest Laboratory	443	0	0	0	0.0%
Sandia National Laboratories	872	175	0	-175	-100.0%
All Other	40,103	21,234	25,055	3,821	18.0%
Total, Natural Gas Technologies	\$44,069	\$22,590	\$26,555	\$3,965	17.6%

Site Description

Argonne National Laboratory (East)

The Argonne National Laboratory (ANL), located in Argonne, Illinois, is a major multi-program laboratory managed and operated for the U.S. Department of Energy (DOE) by the University of Chicago under a performance-based contract. Argonne research for the Fossil Energy Natural Gas Technologies program in FY 2002 and FY 2003 supports Drilling, Completion and Stimulation technology development and Environmental Science R&D. No activities are planned in FY 2004

Idaho National Engineering and Environmental Laboratory

The Idaho National Engineering and Environmental Laboratory (INEEL), located outside of Idaho Falls, Idaho, in FY 2002 and FY 2003 supports research and development in the area of Natural Gas

Technologies for environmental technology development, drilling technology and microbial analysis of gas hydrates. In FY 2004 no activity is planned.

Lawrence Berkeley National Laboratory

The Lawrence Berkeley National Lab (LBNL), located in Berkeley, California, in FY 2002 and FY 2003 conducts research and development in the area of Natural Gas Technologies for environmental analysis and modeling, heavy oil upgrading, reservoir characterization, and gas hydrates characterization. Some reservoir characterization activities will continue in FY 2004.

Lawrence Livermore National Laboratory

The Lawrence Livermore National Lab (LLNL), located in Livermore, California, in FY 2002 and FY 2003, conducts research and development in the area of Natural Gas Technologies for environmental emissions analysis, reservoir geophysics, and hydrates properties

National Energy Technology Laboratory

The National Energy Technology Laboratory (NETL), located in Morgantown, West Virginia, Pittsburgh, Pennsylvania, and Tulsa, Oklahoma, is a multi-purpose laboratory, owned and operated by the U.S. Department of Energy. NETL conducts and implements science and technology development programs for the Department in energy and energy-related environmental systems. NETL's key functions area to shape, fund, and manage extramural (external) RD&D projects, conduct on-site science and technology research, and support energy policy development and best business practices within the Natural Gas Program. NETL has unique capability in hydrogen testing and computational chemistry. These functions will continue in FY 2004.

Oak Ridge National Laboratory

The Oak Ridge National Laboratory (ORNL), located in Oak Ridge, Tennessee, in FY 2002 and FY 2003, conducts research and development in the area of Natural Gas Technologies for oil processing environmental mitigation technologies and characterization of gas hydrates. ORNL has unique capabilities in petroleum product physical measurements. No specific activities are planned in FY 2004.

Pacific Northwest National Laboratory

The Pacific Northwest National Laboratory (PNNL), located in Richland, Washington, in FY 2002 and FY 2003, conducts research and development in the area of Natural Gas Technologies reservoir geophysics and hydrate characterization. No activity is planned in FY 2004.

Sandia National Laboratory

The Sandia National Laboratory (SNL), located in Albuquerque, New Mexico, in FY 2002 and FY 2003, conducts research and development in the area of Natural Gas Technologies for air emissions detection, measurement while drilling technology, and reservoir geomechanical analysis.

All Other

The Department’s Natural Gas Technologies program, within the Fossil Energy and Development program, funds research at major performers at non-DOE locations. Examples of these performers include partnerships with industry, universities, national laboratories, state and local governments, and other organizations. Private sector participation is emphasized through industry cost-sharing with individual companies and consortia to ensure market relevance and to facilitate the transfer of technology to the private sector while leveraging Federal R&D investment. University research supported by this program contributes to U.S. technological leadership.

Detailed Program Justification

	(dollars in thousands)		
	FY 2002	FY 2003	FY 2004
Exploration and Production	19,964	15,450	14,000
This program aims to develop technologies that will overcome major market and technological barriers to increase domestic supply of natural gas at reasonable prices without harm to the environment.			
■ Sustainable Supply	0	0	13,860

Establish new industry-led, university consortia-based program (innovations and invention) to develop crosscutting, breakthrough technologies needed to ensure continued supply of oil and gas beyond 2015. Research will focus on long-term, high-risk, high potential payout projects that may revolutionize the way gas is supplied in the U.S. Program will focus on resource-tailored technologies to find and produce gas from non-conventional reservoirs with minimal environmental impact. Develop technologies for hostile environments (extreme pressure, temperature, and corrosion) encountered in drilling deeper than 16,000 feet. Determine constraints to expanding coalbed methane production in eastern basins.

DOE will continue the National industry-driven Stripper Well Consortium to investigate multiple technologies to improve stripper well production and prevent the abandonment of 8% of total U.S. production. In addition, DOE will support industry-led efforts in technology transfer through workshops and publications focused on the small- to mid-sized independents.

To assure efficient and reliable availability of natural gas to end users, DOE will initiate a National, industry-driven consortium in gas storage (similar to the Stripper Well Consortium), to improve the reliability and efficiency of the existing storage system. The program will also conduct complementary R&D in advanced storage concepts and collect data and develop models for improved LNG facilities siting.

Participants to be determined.

There was no activity in FY 2002 and FY 2003.

(dollars in thousands)

FY 2002	FY 2003	FY '2004
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- **Advanced Drilling, Completion and Stimulation** 5,309 8,515 0

No activity in FY 2004. Technologies for drilling greater than 16,000 feet included in Sustainable Supply above.

FY 2003 and FY 2002 funding continued development of real-time fracture height growth diagnostic tool, ultra-light weight cement for deep water applications, high-pressured coiled tubing drilling system, mud hammer, long-term, revolutionary technologies such as laser drilling and perforations, technologies for drilling deeper than 16,000 feet including high performance drilling and completion systems, advanced coatings and hardening of "Smart" systems and sensors. *Participants included: NETL, Novatek, Mauer, Tempress, Tech Int., Cementing Solutions, Real-Tme Zone, Terra Tek, GTI, TBD*

- **Advanced Diagnostics and Imaging Systems** 5,013 4,580 0

No activity in FY 2004.

FY 2003 and FY 2002 funding continued development of infill drilling optimization in the San Juan basin and Delaware basin of New Mexico, next generation of fracture detection technologies, long-term sustainability of gas supply study in Rocky Mt. basins, improved completion technologies, solutions to high water production problems in tight sand regions, super high resolution seismic tools and shear wave imaging. *Participants included: NETL, ARI, Stanford, LBL, SUNY, SNL, Paulsson Geophysical, University of Texas, Cementing Solutions, N. Mex. Tech.*

- **Multi National Laboratory/Industry Partnership** 2,800 0 0

No activity in FY 2003 and FY 2004 as the program was not aligned with the President's Management Agenda efforts and R&D Investment Criteria guidance to promote competitive awards.

FY 2002 funding continued to support a mix of fundamental and applied research in exploration and production projects identified by industry partners as key, high-risk and long-term. *Participants included: National Labs.*

- **Secondary Gas Recovery Program** 693 500 0

No activity in FY 2004.

FY 2003 and FY 2002 funding continued secondary gas recovery studies in Northern Gulf of Mexico and other major producing basins in U.S. *Participants included: Univ. Texas.*

- **Stripper Wells Revitalization** 748 1,200 0

In FY 2004, this activity will continue under the Sustainable Supply effort described above.

FY 2003 and FY 2002 funding continued National, industry-driven consortium to investigate multiple technologies to improve stripper well production. *Participants included: Penn St. Univ.*

(dollars in thousands)

FY 2002	FY 2003	FY 2004
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■ Technology Transfer	599	500	0
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In FY 2004, this activity will continue under the Sustainable Supply effort described above.

FY 2003 and FY 2002 funding continued industry led efforts in technology transfer. *Participants included: PTTC.*

■ Deep Trek	3,400	0	0
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This activity will continue under Sustainable Supply effort described above. (Also see Advanced Drilling, Completion and Stimulation.)

This activity was combined with Advanced Drilling Completion and Stimulation in FY 2003. In FY 2002 funding continued development of technologies for drilling deeper than 16,000 feet below the earth's surface, including high performance drilling and completion systems, advanced coatings and hardening of "Smart" systems and sensors, low friction, wear resistant coatings/materials. *Participants included: SNL*

■ Coal Bed Methane Water Filtration Research . . .	950	0	0
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No funding is requested for this activity in FY 2004.

No funding requested in FY 2003. FY 2002 funding concluded stratigraphic work to determine location of constructed wetlands in association with large scale coal bed methane production facility.

■ Arctic Research	247	0	0
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No funding requested for this activity in FY 2004

FY 2002 funding continued Arctic Research program for peer reviewed research, conducted outreach and served as liaison between the State and DOE. No funding was requested in FY 2003.

■ Program Support	205	155	140
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Fund technical and program management support.

Gas Hydrates	9,568	4,500	3,500
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Gas Hydrates, located in Alaska and offshore of the U.S., contain huge resources of natural gas (if only 1% were economically producible, we could triple our resource base). In addition to their potential as a resource, hydrates appear to have implications for the global climate. Significant research is needed to provide the knowledge and technology to understand the global climate impact of hydrates by 2010, and commercially produce gas from hydrates starting in 2015-2020, when more conventional resources decline. Because this research is high risk and long-term, and could potentially lower the value of current reserves, there is little incentive for industry to take the lead in hydrate development.

(dollars in thousands)

FY 2002	FY 2003	FY 2004
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■ Gas Hydrates	9,470	4,455	3,465
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In FY 2004 the program will support one ongoing joint industry project needed to drill and test wells in the Gulf of Mexico. Activities related to safe production of oil and gas offshore will be transferred to the private sector beneficiaries. *Participants include: TBD, Chevron Texaco*

FY 2003 and FY 2002 funding continued industry-led field activities to drill and collect samples of naturally occurring hydrate from Alaska permafrost for characterization, Joint Industry Project to understand safety and seafloor stability issues in the Gulf of Mexico, national lab work and Gulf of Mexico Seafloor Monitoring work.. *Participants included: U. Miss., Chevron Texaco, BP, Maurer.*

■ Program Support	98	45	35
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Fund technical and program management support.

Infrastructure	9,809	0	0
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This program develops technology to ensure the reliability and integrity of transmission and utility distribution pipeline systems, to reduce stress corrosion and cracking of gas pipelines, to detect damage to pipelines, and to determine pipeline wall integrity.

■ Storage Technology	2,420	0	0
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In FY 2004, this activity has been combined with the Sustainable Supply program described above.

No funding was requested in FY 2003. FY 2002 funding continued development of technologies for deliverability enhancement and reservoir management, support to industry for metering and measurement, and advanced storage concepts. These activities include development of a direct energy meter for storage applications, and support of large capacity, storage in granitic rock. *Participants included: ARI, Schlumberger-Holditch, Furness-Newburge, NYSEG, TBD*

■ Delivery Reliability	7,289	0	0
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No activity in FY 2004.

In FY 2003, to reduce duplication in government programs, the President's budget transferred \$5 million in budget authority associated with this activity to the Office of Pipeline Safety in the Department of Transportation. FY 2002 funding continued research directed to ensure the reliability and integrity of the gas transmission and distribution network, develop smart automated inside pipeline inspection sensor systems, conduct research on obstacle detection systems for horizontal boring applications for laying distribution pipelines, develop systems capable of detecting external force damage, develop technology to improve the efficiency for reciprocating and turbo compressors, and develop advance technology capable of determining pipeline wall integrity. *Participants included: SWRI, Tuboscope, NYGAS, GTI, Battelle, CSU, ARC, ANL,*

INEEL, LLNL, SNL, ORNL, PNNL, NETL, TBD.

(dollars in thousands)

	FY 2002	FY 2003	FY 2004
■ Program Support	100	0	0
Fund technical and program management support.			
Emerging Processing Technology	2,191	0	6,555
<p>In keeping with the National Energy Policy and the President's Freedom Car Initiative, the Emerging Processing Technology program has been redirected toward research on innovative methods to produce hydrogen from natural gas. Research will also be conducted on the capture of CO₂ generated during the process, which is in line with the President's Climate Change Initiative. FY 2004 activities will be built on past hydrogen related efforts of the Clean Fuels Program. The most promising includes work on membranes to produce hydrogen directly from natural gas and to separate both the reactant oxygen from air in the resultant product gas streams. Additional FY 2004 activities will be to competitively solicit, from industry, academia, and National Laboratories, new ideas on hydrogen production, CO₂ capture, and related supporting needs to produce and deliver hydrogen to the potential user.</p>			
■ Hydrogen From Gas	0	0	6,490
<p>In FY 2004, initiate tests of prototype hydrogen production technologies. Award projects for hydrogen production and capture of associated carbon dioxide from competitive solicitation and National laboratory call for proposals. <i>Participants include: NETL, TBD.</i></p> <p>No funding was requested in FY 2003 and FY 2002.</p>			
■ International Center for Gas Technologies	247	0	0
<p>No activity in FY 2004.</p> <p>FY 2002 funding continued support of an international center for information on natural gas technologies. No funding was requested in FY 2003. <i>Participants included: GTI</i></p>			
■ Coal Mine Methane	1,921	0	0
<p>No activity in FY 2004.</p> <p>No funding requested in FY 2003. FY 2002 funding continued Phase III of coal mine methane projects.</p>			

(dollars in thousands)

	FY 2002	FY 2003	FY 2004
■ Program Support	23	0	65
Fund technical and program management support.			
Effective Environmental Protection	2,537	2,640	2,500
This program seeks to reduce the environmental impacts of gas operations and reduce the cost of environmental compliance through a combination of technology development, risk assessment, and regulatory streamlining. In FY2004 the program will emphasize research that will improve access to onshore public lands, especially in the Rocky Mountain Region, where much of the undiscovered domestic natural gas resource is located and where environmental issues threaten to significantly impede recovery of that resource.			
■ Environmental Science	0	0	2,475
Conduct targeted initiatives to define and solve specific problems in key focus areas, specifically: 1) environmental barriers to coal bed methane production including the use of coal bed methane water as a resource for beneficial uses, and 2) air quality issues affecting natural gas production. Develop objective, credible scientific data for regulatory decisions as part of a program-wide environmental strategy for maintaining sustainable supplies of natural gas. <i>Participants include: NETL, National Labs, TBD.</i>			
In FY 2002 and 2003, project activities were funded in separate key activities described below.			
■ Program Planning Data and Analysis	424	426	0
Activity continued in Environmental Science above.			
FY 2003 and FY 2002 funding continued data collection and the development of analytical tools for program planning, for outreach and technology transfer, including the capability to quantify environmental costs and assess constraints to gas resource recovery, collection and distribution. Continue to perform legislative and regulatory impact analysis related to both upstream and downstream gas environmental issues. <i>Participants to be determined.</i>			
■ Technology Development	1,711	1,000	0
Activity continued in Environmental Science above.			
FY 2003 and FY 2002 funding continued efforts to develop and demonstrate technologies for improving the environmental performance of all gas exploration and production. <i>Participants to be determined.</i>			
■ Outreach and Technology Transfer	376	1,188	0
Activity continued in Environmental Science above.			
FY 2003 and FY 2002 funding continued outreach and technology transfer efforts on			

environmental issues affecting natural gas supply, including compliance efforts with industry, states, and others to identify and address environmental challenges to expanded natural gas production. *Participants to be determined.*

	(dollars in thousands)		
	FY 2002	FY 2003	FY 2004
■ Program Support	26	26	25
Fund technical and program management support.			
Total, Natural Gas Technologies	44,069	22,590	26,555

Explanation of Funding Changes

FY 2004 vs. FY 2003 (\$000)

Exploration and Production

■ Initiate Sustainable Supply to refocus on activities that can create public benefits which industry would not carry out absent Federal assistance	13,860
■ Redirect appropriate Federal activities to Sustainable Supply from Advanced Drilling, Completion, and Stimulation	-8,515
■ Redirect appropriate Federal activities to Sustainable Supply from Advanced Diagnostics and Imaging Systems	-4,580
■ Redirect appropriate Federal activities to Sustainable Supply from Secondary Gas Recovery	-500
■ Combine Stripper Wells Revitalization with Sustainable Supply	-1,200
■ Combine Technology Transfer with Sustainable Supply	-500
■ Program Support	-15

Gas Hydrates

■ Decrease in Gas Hydrates due to termination of several joint industry projects	-990
■ Program Support	-10

Emerging Processing Technology

■ Initiate Hydrogen From Gas	6,490
■ Program Support increase due to initiation of program	65

Effective Environmental Protection

■ Increase due to combined effort in Environmental Science	2,475
■ Combine Program Planning Data and Analysis with Environmental Science	-426
■ Combine Outreach and Technology Transfer with Environmental Science	-1,000
■ Combine Technology Development with Environmental Science	-1,188
■ Program Support	-1

Total Funding Change	3,965
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